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CORONARY HEART DISEASE AND THE MODE OF LIFE*

In 1925 the annual death rate in the United States of white men aged 50-64 was 21.8 per thousand. By 1950 the rate was 19.4, but this modest gain was more than accounted for by declines in mortality from tuberculosis, influenza, pneumonia and accidents. Meanwhile the mortality from heart disease rose from 4.6 to 8.6 in this bracket, though mortality from valvular and endocardial heart disease had dropped by some 20 per cent. Life insurance experience is similar to these vital statistics.[1]

Clearly, the trend in "degenerative" heart disease, primarily coronary heart disease, is a menacing obstacle to the splendid progress of medical science and public health. The point is emphasized by the fact that by the time middle age is reached most Americans have extensive atherosclerosis of the coronary arteries and, even more significantly, this condition has made its appearance in many young men while they are still in their early twenties.[2]

To a variable but smaller extent, many other countries show the same trend. However, atherosclerosis and coronary heart disease is not the universal fate of mankind and therein is a clue and a hope. There is no evidence that this disease has always been prevalent; the presence of calcium in the arteries of a few mummies only means that some ancient Egyptians lived a long time. The epidemiology of heart disease has been long neglected but it is now clear that in many lands, embracing perhaps the majority of the world's population, the incidence of coronary occlusion and myocardial infarction is relatively small and this is not merely because of the age structure of the population.[3, 4]

In Japan, and among Bantu and other Negroes in Africa, to take examples recently studied,[4, 5] the incidence of "degenerative" heart disease is only a small fraction of our own at equal age. People in Italy are less remarkable but if we could match them in this regard 50,000 fewer Americans would die each year in middle age.[4, 6] What is the reason?

The defeatist theory would be that Americans are genetically unfortunate but the evidence is otherwise. Italo-Americans are obviously not immune and American Negroes, at least in Chicago,[7] seem to be no better off than the rest of us. Japanese in Hawaii who are becoming Americanized appear to have less severe atherosclerosis than we do but far more than their relatives in Japan.[8] Major differences in the prevalence of coronary heart disease are obvious when different population segments of the same racial stocks are compared in Spain and in Italy.[6, 9] In general, variations in "susceptibility" to degenerative heart disease are associated with ethnic rather than racial differences.

So the mode of life, and not the race, of the population is clearly of crucial importance. The easiest differentiation to be made along these lines is an economic one. A good case could be made for the proposition that real poverty, and all that goes with it, is an excellent prophylactic against coronary heart disease. But a more penetrating analysis must examine the functional characteristics of the mode of life.

First among these characteristics are physical activity and diet. Habitual lack of physical exercise has been suggested as favoring the development of coronary heart disease.[4, 10] This factor may well be significant, but at best it could account for no more than a small part of the difference between populations. Manual workers in the United States and other countries where coronary heart disease is rife are certainly not immune. Actually, a recent analysis of vital statictics in Chicago failed to show an advantage to manual workers in regard to mortality from coronary heart disease.[8] Furthermore, in populations with little coronary heart disease, all of the men do not do hard physical work. Autopsy studies in Japan fail to show more atherosclerosis in sedentary individuals than in manual workers.[4]

Both the total amount and the kind of diet must be considered in regard to atherogenesis. The relative amount of the diet is reflected, of course, in the relative frequency of obesity and emaciation in the population. Life insurance statistics indicate that, in the United States at least, among men who are more than 20 per cent heavier than the average at the same height and age, mortality from heart disease is 50 per cent higher than in the general population. However,

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autopsy series and surveys of patients with coronary heart disease indicate that the incidence of obesity among coronary victims is not much different from that among clinically healthy controls.[10] Obviously, the protection afforded by being thin is highly limited.

Even more significant is the fact that obesity is not absent among populations in whom coronary heart disease is relatively infrequent. An appreciable number of Bantu are overweight and in Italy the relative body weight in most of the group observed was at least equal to that in American men.[6, 12]

The character of the diet seems to be more significant, An outstanding feature of all populations known to have relatively little coronary heart disease is the low consumption of fats. The amounts of vitamins and minerals are highly variable in their diets and the proportion of the total calories provided by proteins covers the range characteristic of high coronary disease populations. However, no more than 20 per cent of calories from fats is the rule. The high coronary disease populations, in contrast, range from about 35 per cent fat calories, as in England, to the United States' average of over 40 per cent. Intermediate fat intakes, as in the region of Emilia in Italy, seem to be associated with an intermediate incidence of coronary heart disease. By itself, these facts might mean merely an interesting association, with no necessary causal connection, between two variables. However, a good reason for a real cause and effect relationship is evident if one studies the cholesterol-lipoprotein system in the blood.

Experiments in man show that the fat, but not the cholesterol, content of the diet has a strong effect on the blood cholesterol level of man.[13, 14] After changing from an ordinary American diet to a very low fat diet, such as the rice-fruit diet, the serum cholesterol begins to fall in a day or so and after a few weeks the value may be 30 per cent or more below the previous "normal" for the individual. When fat is restored to the diet, the blood cholesterol level promptly rises. Other very low fat diets give comparable results whether or not they are as devoid of dietary cholesterol as the rice-fruit diet. Man, unlike the rabbit and the chick, is substantially independent of the cholesterol intake over the whole range of natural diets.

It is unnecessary to go to such dietary extremes to achieve at least a moderate lowering of the serum cholesterol in most people. A diet providing 15 or 20 per cent of calories from fats is usually demonstrably effective in a few weeks, though in such short periods the blood level seldom falls to the values characteristically found in populations where diets equally low in fats are the life-long subsistence.

The really long-time effects on the cholesterol-lipoprotein concentration in the blood are shown in studies on populations whose diets differ in fat content. Many population samples studied in Spain, Sweden, Africa, and various parts of Italy, as well as in the United States, show a striking relationship between the diet and the total and beta lipoprotein cholesterol. This seems to be in remarkable conformity with the incidence of coronary heart disease in those populations.[4, 5, 15]

After 30 or more years of living and eating as is customary in high coronary disease regions, is it possible to hope that a change in the mode of life can alter the outlook for coronary heart disease? The best evidence concerning this is seen in the great involuntary experiment produced by World War II.[16-21] In countries such as Finland and Norway, where the medical and public health services and records were maintained and where fat consumption was sharply reduced, mortality from coronary heart disease fell sharply in less than two years. Where the reduction in dietary fat was less pronounced or less prolonged, as in Sweden and the Netherlands, coronary heart disease also showed a decrease but less dramatically than above. With the resumption of the "good" old fatty diets after the war, coronary heart disease rose to the old level or exceeded the former figures for all these countries. In countries where the other impacts of war were similar, but the dietary fat was unaffected, as in Denmark, the yearly toll of coronary heart disease did not change.

The converse is shown in Israel where there has been a continuing influx of Jews from Yemen who were accustomed to a low fat diet and relative freedom from coronary heart disease. After some years in Israel, with the diet changing towards the richer pattern of the European Jews, their serum cholesterol values are far higher than those in the recently arrived Yemenites and they, too, developed an increasing incidence of coronary heart disease.[22]

Atherogenesis is not the only factor in coronary heart disease. It has been suggested that the modern rise in the incidence of mortality from coronary heart disease is more a reflection of a rise in thrombus formation than of increased atherogenesis. This may be disputed, but thrombotic occlusions *can* occur without any great degree of sclerosis, and many a coronary artery is severely sclerosed for years without causing coronary heart disease. Thrombus formation needs more attention but in this question, too, the dietary fat may be important. In Africa, we learned that the Bantu is singularly free of thrombo-embolic complications after surgery. This corresponds to studies in the Dutch East Indies where, again, there is a low-fat diet and a low incidence of coronary disease in the population. Thrombo-embolic complications after major surgery, childbirth and fractures are apparently excessively rare among these people.[20, 23] It is significant that during World War II the change in the incidence of mortality from coronary disease, at least in Norway, was paralleled by a sharp decline in thrombo-embolic complications after surgery.[21]

This, then, is the general picture of the penalty of a luxurious, high-fat diet. But many questions of great importance remain. What is the role

of hypertension in all this? It may be contributory but we note that hypertension is common in Southern Italy and in Japan and is not rare among the Bantu. Then, what is the influence of physical exercise on cholesterol metabolism? And is there any significance to the fact that many natural low-fat diets are also high residue diets, or that these diets are generally low in meats and other sources of proteins?

Particularly intriguing is the question as to the relative cholesterogenic and atherogenic effects of different dietary fats. In short-term controlled experiments there is no doubt that all fats are not equivalent in their effects on the cholesterol-lipoprotein system. It is doubtful whether simple differences in relative saturation of the fatty acids is the full answer.

A permanent reduction in the dietary fat of our population would raise many questions. Good nutrition, with plenty of variety and esthetic appeal, could not be sacrificed. Adequate amounts of proteins, vitamins, minerals and "essential" fatty acids must be provided. This would not be difficult while maintaining 20 per cent of calories from fats. Limited amounts of lean meat, eggs and cheese would be allowable. Most sea food and fish (except mackeral, tuna, salmon and Atlantic herring) are low in fat and could be eaten in unlimited amounts in low-fat diets. The consumption of skimmed milk, cottage cheese, green and yellow vegetables and fruits could be encouraged. Frying, especially in deep fat, would have to be limited and the liberal use of fat-rich sauces, gravies and salad dressings would be contra-indicated. Even bread would need to be scrutinized, not only because of the question of fat spreads, but also because most commercial bread in America at present is made with fat. Many excellent breads, including true French bread, are made without fat but they have a shorter shelf life unless they are frozen. Bread, incidentally, raises a question. If fats are reduced in the diet, the calorie level would be maintained mainly by increasing the carbohydrates, which means bread, spaghetti, rice, potatoes and so on. Perhaps a little reduction in calories would not be such a bad idea for most American adults.

Obviously, a major choice is looming, both for coronary patients and for potential coronary patients, and, unfortunately, the latter category includes most American adults at the present time. Are we to continue the trend towards higher and higher fat diets? In the past 40 years the national average has risen from about 30 per cent of calories from fats to the current level of over 40 per cent. Studies on the diets eaten by American soldiers show around 45 per cent fat calories![3]

The issue is not met by asking, "Who wants to be a Bantu?" No one wants to live on mealie meal but reasonably low-fat diets can provide infinite variety and esthetic satisfaction to satisfy the most fastidious, if not the most gluttonous, among us. Cook books would need re-writing, perhaps, and culinary skill would be at a higher premium than now, but Italian and Chinese cuisines show what can be done without dependence on literally "living off the fat of the land."

It is not insisted that dietary fat is the whole story or that a low fat diet is the full and only answer. Dosing the whole nation with drugs is hardly conceivable even if—and it is a big if—half on ounce of phytosterols after each meal could counteract some of our dietary faults. The old Romans were said to have had not dissimilar notions about correcting dietary indiscretions.

The incidence of myocardial infarction among American men aged 50 is not simply a little higher than among men of the same age in populations who live on low-fat diets; it is *many times* higher. There is no proof that *all* of this tremendous difference is ascribable to the fat *per se*. Other factors beside the diet need more attention but it is fair to say that, except for physical exercise, no other clue is in sight. Even the concept that "stress and strain" is influential needs study because of the complete absence of evidence for its validity. Arnott[25] has neatly indicated the psychological basis for the acceptance and persistence of the "stress and strain" idea: "How much nicer it is when stricken with a coronary thrombosis to be told that it is all due to hard work, laudable ambition, and selfless devotion to duty than to be told it is due to gluttony and physical indolence."

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REFERENCES

1. Lew, E. A.: Some implications of recent changes in mortality. Proc. 62nd Ann. Meet. Assoc. Life Insur. Med. Dir. America, 1953.
2. Enos, W. F., Holmes, R. H., and Beyer, J.: Coronary disease among United States soldiers killed in action in Korea. J. A. M. A. **152:** 1090, 1953.
3. Keys, A.: The diet and degenerative heart disease. Proc. 42nd Ann. Meet. Med. Sect. Amer. Life Convention, 1954.
4. Papers by P. D. White, A. Keys, J. N. Morris, J. Higginson, G. Biörck, and N. Kimura in "The Epidemiology of Cardiovascular Disease—Proceedings of the Second International Congress of Cardiology 1954," Hoeber, N. Y., 1956.
5. Stewart, B. B., Brock, J. F., and Keys, A.: Serum cholesterol, the diet, and the relationship to the incidence of coronary heart disease. An interracial survey in the Cape Peninsula. Lancet, Nov. 26, 1955.
6. Keys, A., Fidanza, F., Scardi, V., Bergami, G., Keys, M. H., and di Lorenzo, F.: Studies on serum cholesterol and other characteristics on clinically healthy men in Naples. Arch, Int. Med. **93:** 328, 1954.
7. Stamler, J.: Proc. Symposium on Arteriosclerosis, Minn. Heart. Assoc.-U. Minn., in press, 1955.
8. Larsen, N. P.: The animal fat diet and atherosclerosis. Hawaii Med. J. **14:** 485, 1955.
9. Keys, A., Vivanco, F., Rodriguez Miñon, J. L., Keys, M. H. and Castro-Mendoza, H.: Studies on the diet, body fatness and serum cholesterol in Madrid, Spain. Metabolism, **3:** 195, 1954.
10. Morris, J. N., Heady, J. H., Raffle, P. H. B., Roberts, C. G. and Parks, J. W.: Coronary heart disease and physical activity of work. Lancet Nov. 21 and 28, 1053 and 1111, 1953.
11. Keys, A.: Obesity and heart disease. J. Chronic Dis. **1:** 456, 1955.
12. Keys, A., Fidanza, F., and Keys, M. H.: Further studies on serum cholesterol of clinically healthy men in Italy. Voeding **16:** 492, 1955.
13. Keys, A.: Human atherosclerosis and the diet. Circulation **5:** 115, 1952.
14. Keys, A. and Anderson, J. T.: The relationship of the diet to the development of atherosclero-

sis in man. Symposium on Atherosclerosis, Publ. No. 338, Nat. Acad. Sci., 181, 1955.
15. Keys, A., Anderson, J. T., Fidanza, F., Keys, M. H. and Swahn, B.: Effects of diet on blood lipids in man: particularly cholesterol and lipoproteins. Clin. Chem. **1:** 34, 1955.
16. Vartiainen, I. and Kanerva, K.: Atherosclerosis and war-time. Ann. med. int. Fenniae **36:** 748, 1947.
17. Malmros, H.: The relation of nutrition to health —a statistical study of the effect of war-time on arteriosclerosis, cardiosclerosis, tuberculosis and diabetes. Acta Med. Scand., Suppl. **246:** 137, 1950.
18. Strøm, A. and Jensen, A. R.: Mortality from circulatory diseases in Norway. Lancet **260:** 126, 1951.
19. Pihl, A.: Cholesterol studies. II. Dietary cholesterol and atherosclerosis. Scand. J. Clin. Lab. Inves. **4:** 122, 1952.
20. Van Unnik, J. and Straub, M.: The frequency of thrombosis and pulmonary embolism in East and West. Docum. Med. Geog. et. Trop. **5:** 261, 1953.
21. Strøm, A.: The influence of wartime on health conditions in Norway. Inst. Soc. Med. Univ. Oslo, 1954.
22. Schindel, L.: Changes of serum total lipids, total cholesterol and lipid-phosphorus in Jewish Yemenite immigrants after twenty years in Israel. J.A.M.A., in press, 1955.
23. Reddingius, T.: Postoperative Thrombose und Embolie in den Tropen. Zbl. f. Chirurg. **58:** 1953, 1931.
24. Ahrens, E. H., Jr., Tsaltas, T. T., Hirsch, J., and Insull, W., Jr.: Effects of dietary fats on the serum lipids of human subjects. J. Clin. Invest. **34:** 918, 1955.
25. Arnott, E. M.: The changing aetiology of heart disease. Brit. Med. J. Oct. 16, p. 891, 1954.

The opinions and conclusions expressed herein are those of the author and do not necessarily represent the official views of the Scientific Council of the American Heart Association.

ABSTRACTS OF PAPERS
for
THE 29th ANNUAL SCIENTIFIC SESSIONS
AMERICAN HEART ASSOCIATION

The 29th Annual Scientific Sessions of the American Heart Association will be held in Cincinnati, Ohio, October 27, 28, 29, 1956 in conjunction with the Association's Annual Meeting. Those interested in presenting papers must submit their abstracts by *May 15.* Abstracts will be accepted only on forms which may be obtained from the Medical Director, American Heart Association, 44 East 23rd Street, New York 10, New York.

Papers intended for presentation should be based on original investigations in or related to the cardiovascular field. The abstracts must be 300 words or less and should contain in summary form the results obtained and the conclusions reached. Abstracts must be submitted in triplicate.

The Scientific Sessions this year will feature an enlarged section for Scientific Exhibits. Requests for space and application forms can also be obtained from the Association's Medical Director. The deadline for these applications is May 15, 1956. All exhibit applications will be acted upon by the Program Committee of the Scientific Council.

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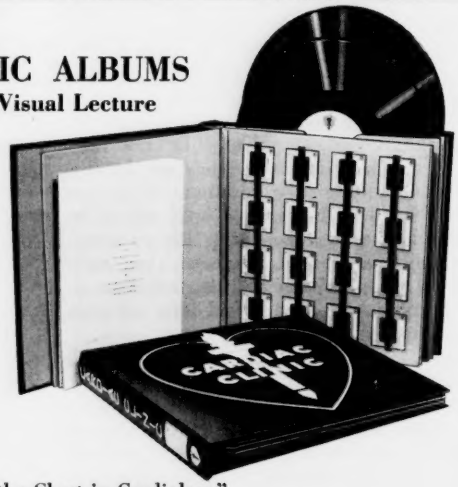

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